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GEOLOGICAL SURVEY

GEOPHYSICAL AND LITHOLOGIC LOGS FOR SIX DRILL HOLES IN THE
NORTHEASTERN PART OF THE ROCK SPRINGS UPLIFT,
SWEETWATER COUNTY, WYOMING

By
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This report has not been edited
for conformity with Geological
Survey editorial standards or
stratigraphic nomenclature.

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INTRODUCTION

During July 1976, the U.S. Geological Survey drilled and logged six holes in the Superior, Wyo. area (figs. 1-4). Information on the extent, thickness, and depth of coal beds was obtained for evaluation and classification of federally owned coal resources. Drill-hole locations were selected on the bases of lease applications, geologic mapping, and availability of existing roads.

A truck-mounted rotary drilling rig, belonging to the U.S. Geological Survey, drilled with air and water. Drill cuttings were sampled and described at continuous 5-ft (1.5-m) intervals (see pages 8-32). Each hole was logged by gamma-gamma, neutron, natural gamma, caliper, spontaneous potential, and log and short normal resistivity¹. (figs. 6-11). To aid in the future collection of ground-water data, all holes except RS-1-S were cased with polyvinylchloride with removable caps.

Within a 5-ft (1.5-m) sample interval, rock types are described in order of decreasing abundance, unless a slash is used to show stratigraphic order. Equal quantities of rock types are indicated by the word "and". "Trace" refers to a relative abundance of 3 percent or less, and with coal, it commonly signifies sample contamination.

¹Only single point resistance could be measured at RS-6-S when equipment was malfunctioning.

Depth and thickness of coals were interpreted from the three radioactivity logs and the lithologic description (fig. 5).

Numerous, thin coal beds were penetrated in the Almond Formation in the Point of Rocks quadrangle and in the Lance and basal Fort Union Formations in the Superior quadrangle. Over half of the coals that were 4 feet or more thick contained partings or impure coal (shaly or sandy). Additional drilling for coal in the basal Fort Union Formation was prevented by inaccessibility of drill sites and lack of drilling mud to maintain circulation.

Acknowledgments

The drill rig was operated by a U.S. Geological Survey crew consisting of J. D. Cathcart, H. Blevins, and J. Abbott under the supervision of J. D. Tucker. Lithologic samples were described by T. J. Pike, and geophysical logging was done by R. A. McCullough of the U.S. Geological Survey. Pacific Power and Light Company provided water for drilling and storage space for casing.

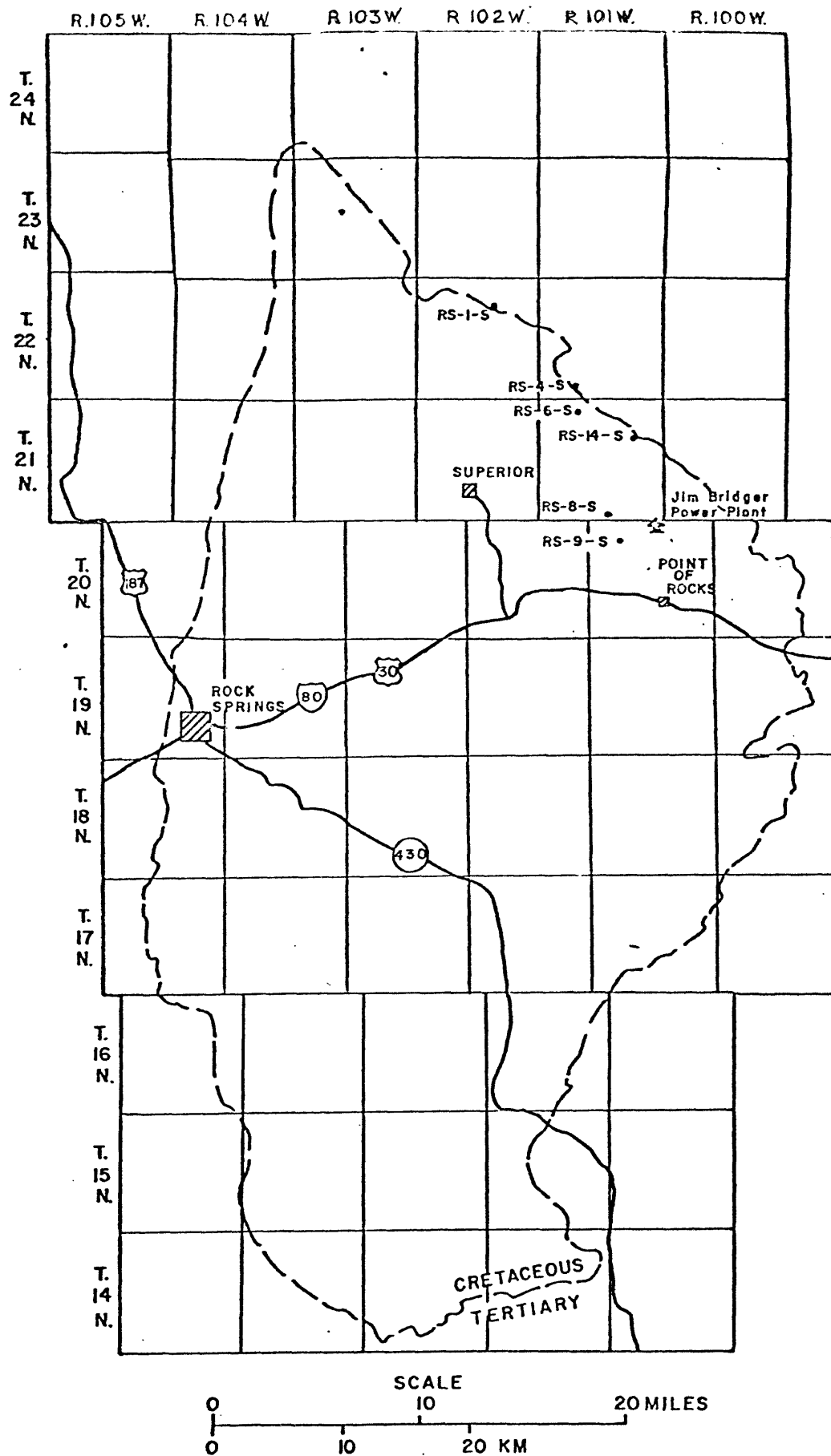


Figure 1.--Location of drill holes within the Rock Springs uplift.

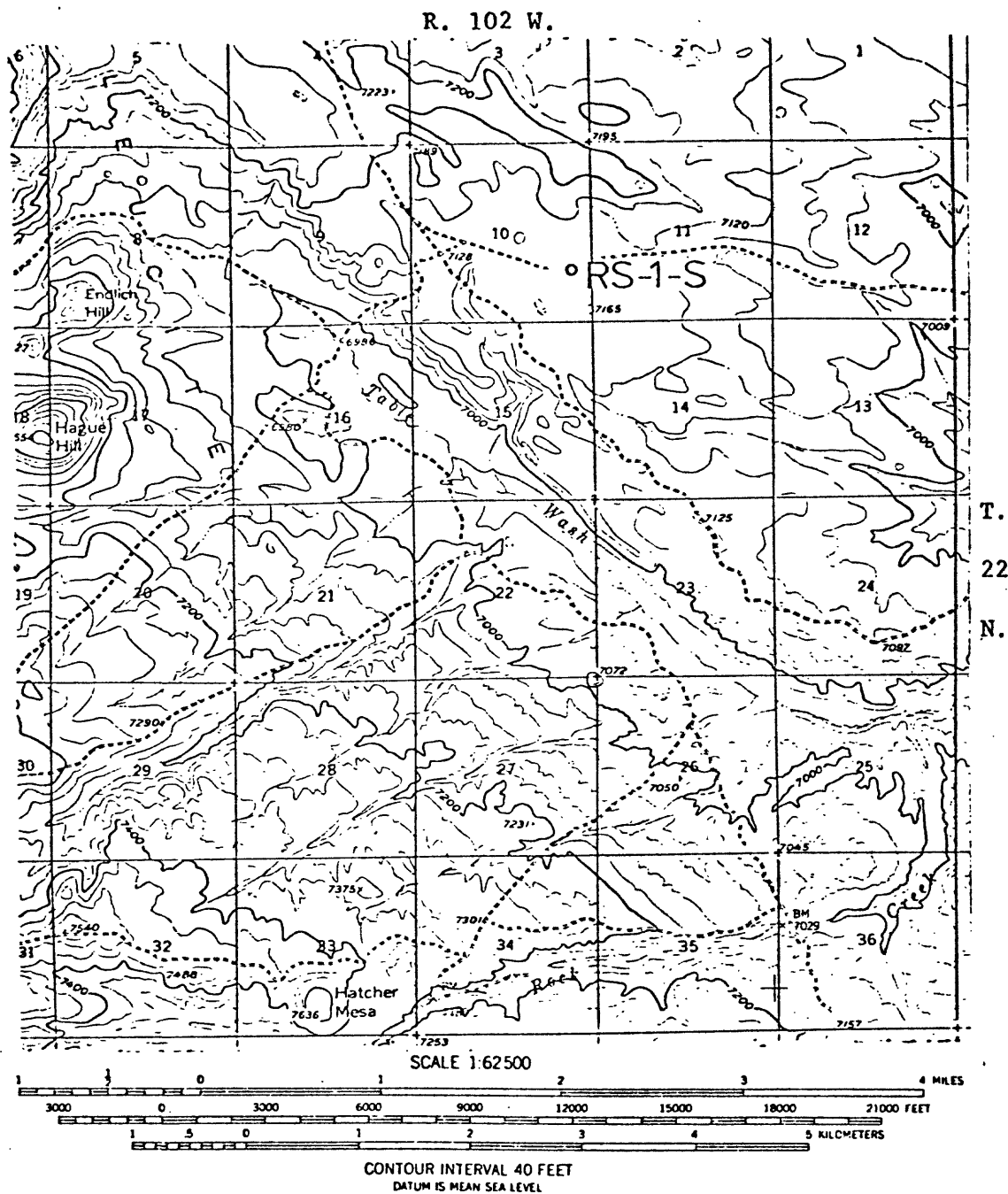


Figure 2.--Location of a drill hole in the northwest quarter of the Superior quadrangle.

R. 101 W.

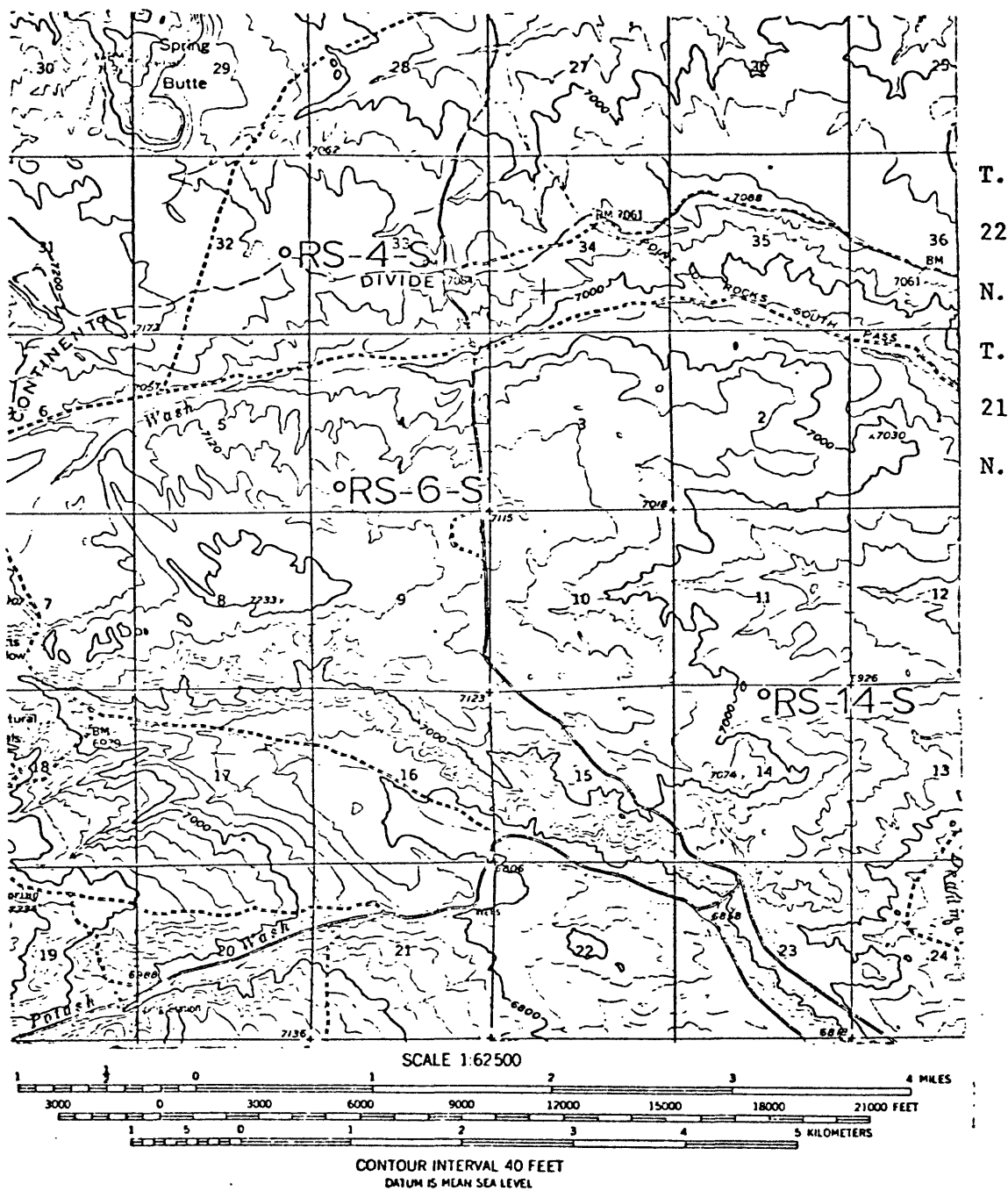


Figure 3.--Location of drill holes in the southeast quarter of the Superior quadrangle.

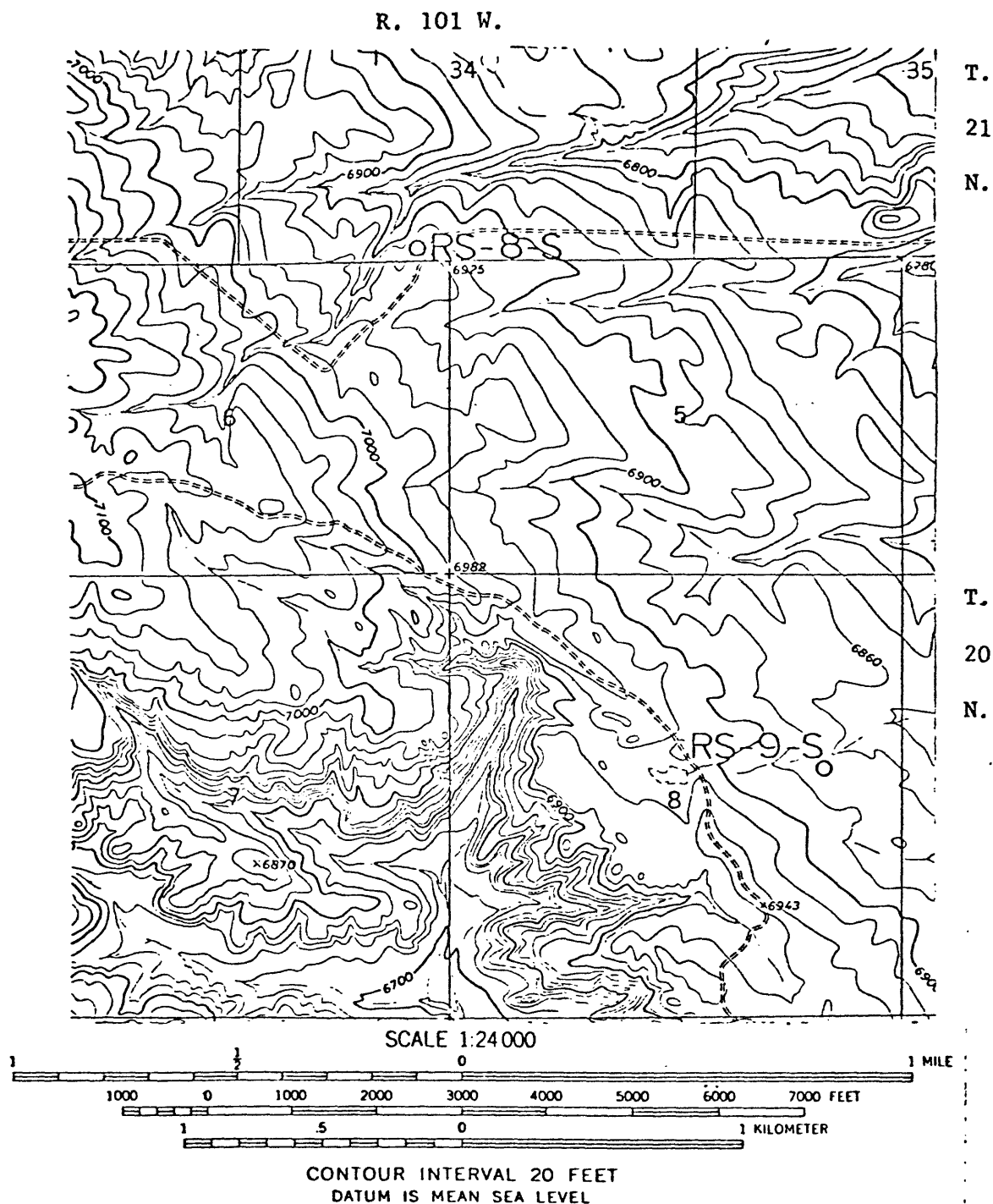


Figure 4.--Location of drill holes in the Point of Rocks quadrangle.

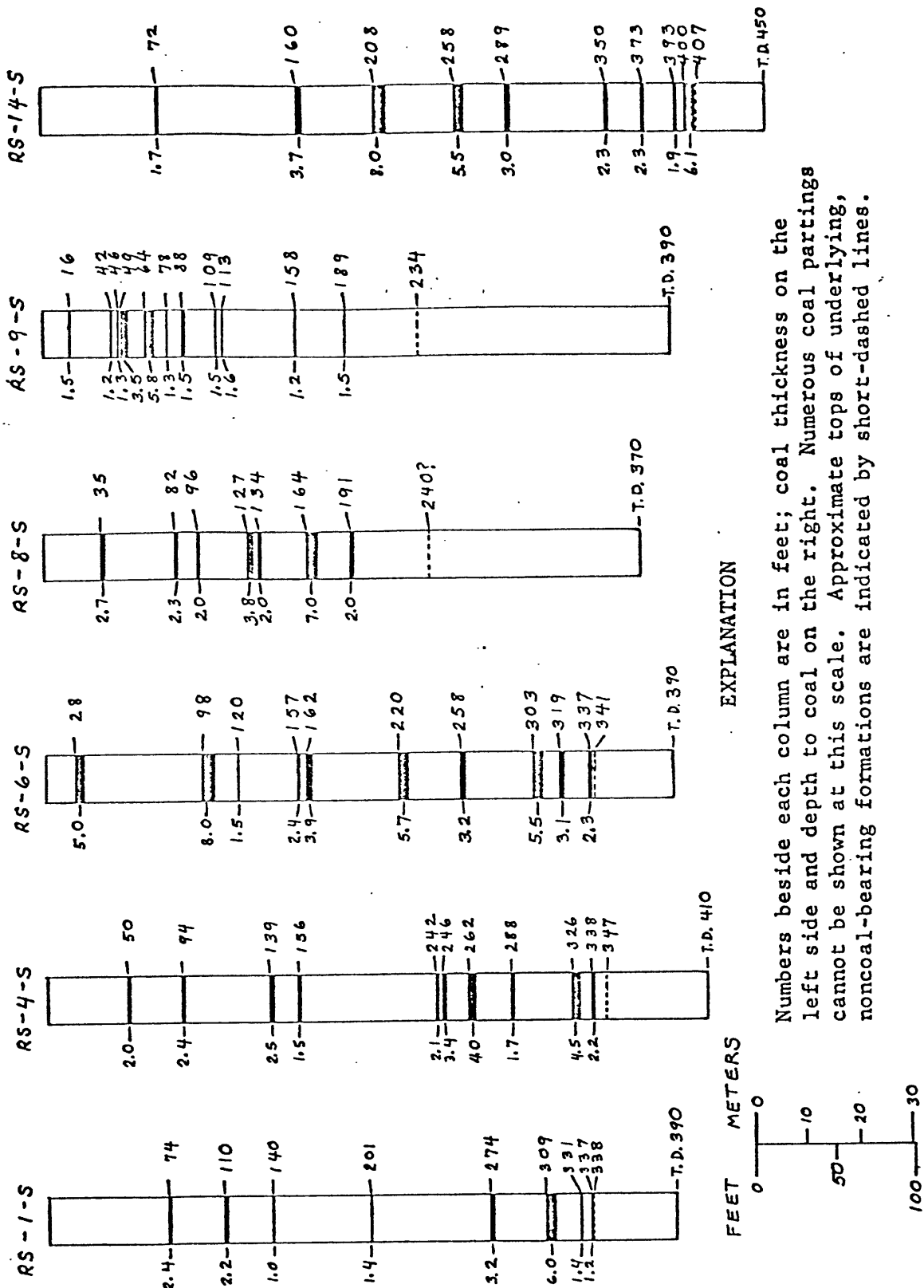


Figure 5.--Coal sections interpreted from geophysical logs.

Drill-hole RS-1-S

Location: NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 10, Total depth: 390 ft
T. 22 N., R. 102 W. Elevation: 7,150 ft
1,600 ft FSL 570 ft FEL Superior quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	<u>Depth (ft)</u>	
	<u>From</u>	<u>To</u>
Sandstone, medium- to fine-grained, tan to light-brown, well sorted-----	0	70
Sandstone, fine-grained, light-gray/carbonaceous material with some coal-----	70	75
Sandstone, fine-grained, light-gray and carbonaceous material; carbonaceous shale? (may be base of Fort Union Formation)---	75	80
Sandstone, fine-grained, brown; trace coal (may be top of Lance Formation)-----	80	85
Sandstone, fine-grained, gray; trace coal-----	85	90
Sandstone, fine-grained, gray-----	90	95
Sandstone, fine-grained, dark-gray-----	95	105
Sandstone, fine-grained, gray; shale, gray-----	105	110
Coal-----	110	115
NOTE: Circulation was lost. Water and drilling soap were injected. As a result, the following samples are poor.		
Shale, silty, gray; coal-----	115	125
Shale, silty, gray; claystone, gray-----	125	130
Shale, silty, gray-----	130	140
Coal; carbonaceous shale; shale, silty, gray-----	140	145
Shale, gray; trace carbonaceous shale and coal-----	145	150

Drill-hole RS-1-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Mudstone, gray; shale, dark-gray-----	150	155
Shale, gray; siltstone, gray-----	155	160
Mudstone, gray; shale, gray; sandstone, fine-grained, gray; carbonaceous shale or shale, brown, very hard-----	160	165
Shale, gray; claystone, gray-----	165	170
Mudstone, gray; shale, gray; carbonaceous shale-----	170	175
Shale, gray; trace carbonaceous shale-----	175	180
Sandstone, medium-grained, gray-----	180	185
Siltstone, gray-----	185	190
Do.; shale, gray-----	190	195
Shale, silty, gray-----	195	200
Shale, gray; carbonaceous shale; coal-----	200	205
Shale, gray; carbonaceous shale-----	205	210
Shale, gray-----	210	215
Sandstone, medium-grained, gray-----	215	220
Do., shell fragments(?); trace coal-----	220	225
Sandstone, medium-grained, gray; trace coal-----	225	230
Siltstone, gray; shale, gray; carbonaceous shale-----	230	235
Carbonaceous shale; sandstone, fine-grained, gray; shale, gray-----	235	240
Siltstone, gray; carbonaceous shale; sandstone, fine-grained, gray-----	240	245
Sandstone, fine-grained, gray; carbonaceous shale; coal-----	245	250

Drill-hole RS-1-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, gray; carbonaceous shale; trace sandstone, fine-grained, gray-----	250	255
Sandstone, fine-grained, gray; carbonaceous shale-----	255	260
Shale, silty, gray; trace carbonaceous shale-----	260	265
Shale, silty, gray-----	265	270
Shale, gray; trace sandstone, fine-grained, gray; trace carbonaceous shale-----	270	275
Coal; carbonaceous shale; shale, gray-----	275	280
Shale, gray; coal; carbonaceous shale-----	280	285
Shale, gray; carbonaceous shale-----	285	290
Siltstone, gray; sandstone, fine-grained, gray; carbonaceous shale-----	290	295
Sandstone, fine-grained, gray; carbonaceous shale-----	295	300
Siltstone, gray; carbonaceous shale-----	300	305
Shale, gray; shale, dark-gray-----	305	310
Carbonaceous shale; coal; shale, gray-----	310	315
Coal(?), dull-----	315	320
Shale, gray-----	320	325
Do; shells-----	325	330
Coal; sandstone, fine-grained, gray-----	330	335
Shale, silty, dark-gray-----	335	340
Sandstone, fine-grained, gray; shale, gray; shells; trace coal-----	340	345

Drill-hole RS-1-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, gray; shale, gray; coal; shells (base of Lance Formation)-----	345	350
Sandstone, medium-grained, gray; coal (top of Fox Hills Formation)-----	350	370
Sandstone, fine-grained, gray; trace coal and siltstone-----	370	375
Sandstone, fine-grained, gray; shale, dark-gray-----	375	380
No sample--probably fine-grained sandstone-----	380	385
Shale, silty, gray; sandstone, fine-grained, gray; trace carbonaceous shale and coal-----	385	390

Drill-hole RS-4-S

Location: NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 32
T. 22 N., R. 101 W.
2,440 ft FSL 700 ft FEL

Total depth: 410 ft
Elevation: 7,110 ft
Superior quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	<u>Depth (ft)</u>	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, tan; shale, gray (near base of Fort Union Formation)-----	0	5
Sandstone, fine-grained, white-----	5	20
Do.; sandstone, fine-grained, tan-----	20	25
Shale, silty, gray; shale, gray; sandstone, fine-grained; tan; mudstone, brown (near top of Lance Formation)-----	25	30
Sandstone, medium-grained, light-brown; shale, gray; shale, brown; clinker(?), salmon-red; trace carbonaceous shale----	30	35
Shale, dark-gray, slightly carbonaceous; sandstone, medium-grained, brown-----	35	40
Shale, dark-gray, carbonaceous; carbonaceous shale; sandstone, fine-grained, brown-----	40	45
Shale, dark-gray; carbonaceous shale-----	45	50
Shale, dark-gray and carbonaceous shale; trace coal-----	50	55
Sandstone, very fine grained; shale, gray/ coal with some carbonaceous shale-----	55	60
Siltstone, gray; sandstone, very fine grained, gray-----	60	65
Siltstone, gray; shale, silty, gray-----	65	70
Siltstone, gray-----	70	75
Do. / carbonaceous shale-----	75	80

Drill-hole RS-4-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale and silty shale, gray-----	80	85
Shale, gray; siltstone, gray-----	85	90
Siltstone, gray; shale, gray-----	90	95
Siltstone, gray / carbonaceous shale with a trace of coal-----	95	100
Sandstone, fine-grained, gray-----	100	105
Do./ Shale, gray and carbonaceous shale-----	105	110
Shale, dark-gray; mudstone, carbonaceous; trace coal-----	110	115
Siltstone to fine-grained sandstone, gray-----	115	120
Siltstone, gray-----	120	130
Siltstone to fine-grained sandstone, gray-----	130	135
Shale, gray-----	135	140
Carbonaceous shale and siltstone, carbonaceous (?)-----	140	145
Coal/shale, silty, gray and siltstone, gray-----	145	150
Siltstone, gray; shale, silty, gray-----	150	155
Siltstone, gray; shale, gray-----	155	160
Coal and carbonaceous shale/sandstone, fine-grained, gray-----	160	165
Carbonaceous shale-----	165	170
Carbonaceous shale (water injection began)-----	170	175
Shale, silty, gray; trace coal-----	175	180
Siltstone, gray; carbonaceous shale; trace coal-----	180	185
Shale, silty, gray; carbonaceous shale; coal-----	185	190
Shale, sandy, gray; sandstone, fine-grained, gray-----	190	195
Sandstone, fine-grained, gray; sandstone, medium-grained, gray-----	195	200

Drill-hole RS-4-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, silty, gray; sandstone, fine- to medium-grained, gray; carbonaceous shale-----	200	205
Shale, silty, dark-gray-----	205	210
Carbonaceous shale; coal; shale, silty, gray-----	210	215
Shale, silty, gray; carbonaceous shale-----	215	220
Shale, silty, gray-----	220	225
Do.; impure coal-----	225	230
Shale, silty, gray; sandstone, medium-grained, gray; trace impure coal-----	230	235
Shale, silty, gray; carbonaceous shale-----	235	240
Sandstone, fine-grained, gray; shale, silty, gray; carbon- aceous shale-----	240	245
Siltstone, gray; shale, silty, gray-----	245	248
Carbonaceous shale; shale, silty, gray; coal (extra sample)-----	248	250
Coal; shale, silty, gray-----	250	255
Carbonaceous shale; shale, silty, gray-----	255	260
Carbonaceous shale and siltstone, gray-----	260	265
Shale, gray; coal-----	265	270
Coal; carbonaceous shale; shale, gray-----	270	275
Sandstone, medium-grained, gray; shale, gray; trace coal-----	275	280
Shale, gray; carbonaceous shale-----	280	285
Carbonaceous shale; shale, silty, gray-----	285	290
Sandstone, fine-grained, gray; shale, gray; coal-----	290	295

Drill-hole RS-4-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, silty, gray; siltstone, gray-----	295	300
Shale, gray; carbonaceous shale-----	300	305
Shale, gray; trace carbonaceous shale and coal-----	305	310
Shale, silty, gray; carbonaceous shale-----	310	315
Carbonaceous shale; siltstone-----	315	320
Sandstone, fine-grained, gray; carbonaceous shale-----	320	325
Siltstone, gray-----	325	330
Coal; some carbonaceous shale; shale, gray-----	330	335
Coal; sandstone, fine-grained, gray-----	335	340
Carbonaceous shale; sandstone, fine-grained, gray; trace coal-----	340	345
Sandstone, fine-grained, gray; coal; shale, gray-----	345	350
Siltstone, gray (May be base of Lance Formation)-----	350	355
Sandstone, fine-grained; shale, gray (May be top of Fox Hills Formation)-----	355	360
Sandstone, very fine grained, gray-----	360	365
Siltstone, gray-----	365	370
Shale, silty, gray-----	370	385
Siltstone, gray-----	385	390
Sandstone, fine-grained, gray-----	390	410

Drill-hole RS-6-S

Location: SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 4
T. 21 N., R. 101 W.
770 ft FSL 900 ft FWL

Total depth: 390 ft
Elevation: 7,140 ft
Superior quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	<u>Depth (ft)</u>	
	<u>From</u>	<u>To</u>
Sandstone, very fine grained, brown-----	0	5
Siltstone, brown-----	5	10
Sandstone, very fine grained, tan-----	10	15
Sandstone, fine-grained, light-brown; trace mudstone, brown--	15	20
Sandstone, very fine to fine-grained, grayish-brown-----	20	25
Shale, brown; shale, silty, brown; trace carbonaceous shale--	25	30
Claystone, light-brown / carbonaceous shale and coal-----	30	35
Shale, silty, bluish-gray / carbonaceous shale and coal-----	35	40
Siltstone, brown; shale, gray-----	40	50
Siltstone, brown-----	50	55
Shale, silty, light-gray and bluish-gray-----	55	60
Siltstone, light-brown-----	60	65
Do.; sandstone, fine-grained, light-brown-----	65	70
Sandstone, fine-grained, light-brown-----	70	75
Sandstone, silty, light-brown-----	75	80
Siltstone, light-brown; shale, brown-----	80	85
Siltstone, light-brown-----	85	90
Siltstone, gray-----	90	95
Sandstone, fine-grained, gray-----	95	100
Coal; trace carbonaceous shale-----	100	110

Drill-hole RS-6-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Coal / carbonaceous shale-----	110	115
Siltstone, carbonaceous (soil zone at base of Fort Union Formation?)-----	115	120
Shale, gray; coal; sandstone, dark-brown; carbonaceous shale (top of Lance Formation?)-----	120	125
Shale, gray; sandstone, gray (minor)-----	125	130
Shale, gray; sandstone, fine-grained, grayish-brown-----	130	135
Shale, slightly silty, gray-----	135	140
Sandstone, medium-grained, dark-gray-----	140	145
Siltstone, gray; shale, gray-----	145	150
Shale, gray, bentonitic; carbonaceous shale; coal-----	150	155
Shale, gray, bentonitic; siltstone, gray-----	155	160
Shale, gray; carbonaceous shale-----	160	165
Coal-----	165	170
Shale, gray; trace sandstone, fine-grained; trace coal-----	170	175
Shale, slightly silty, gray; siltstone, brown-----	175	180
Shale, gray-----	180	185
Carbonaceous shale; coal; shale, gray-----	185	190
Shale, gray; shale, silty, gray-----	190	195
Siltstone, gray; sandstone, medium-grained, light-gray-----	195	200
Sandstone, medium-grained, light-gray-----	200	205
Shale, silty, gray; sandstone, very fine grained, gray; trace coal-----	205	210
Shale, slightly silty, gray; siltstone, gray-----	210	215

Drill-hole RS-6-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, gray; siltstone, gray-----	215	220
Siltstone, gray; sandstone, fine-grained, gray; coal-----	220	225
Coal; claystone and fine-grained sandstone, gray-----	225	230
Carbonaceous shale; shale, dark-gray-----	230	235
Shale or mudstone, gray-----	235	240
Shale, gray; carbonaceous shale; siltstone-----	240	245
Shale, silty; carbonaceous shale-----	245	250
Carbonaceous shale; shale, gray-----	250	255
Shale, gray; siltstone, carbonaceous-----	255	260
Coal; shale, silty, gray-----	260	265
Siltstone, gray; coal; sandstone, very fine grained, gray; carbonaceous shale-----	265	270
Shale, silty, gray-----	270	275
Sandstone, fine-grained, gray; carbonaceous shale; coal; shale, gray-----	275	280
Shale, gray; siltstone, gray-----	280	285
Shale, gray; sandstone, fine-grained, gray-----	285	290
Sandstone, fine-grained, gray, very hard; trace coal-----	290	295
Shale, silty, gray-----	295	300
Sandstone, very fine grained, gray; shale, silty, gray; trace coal-----	300	305
Shale, silty, gray; carbonaceous shale and coal-----	305	310
Coal; sandstone, fine-grained, gray-----	310	315

Drill-hole RS-6-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, silty, gray; sandstone, fine-grained, gray; coal-----	315	320
Coal; shale, silty, gray; carbonaceous shale-----	320	325
Sandstone, fine- to medium-grained, gray; shale, silty, gray; trace coal-----	325	330
Sandstone, fine-grained, gray; coal; carbonaceous shale-----	330	335
Shale, silty, gray; carbonaceous shale; mudstone, gray-----	335	340
Coal; sandstone, medium-grained, gray; shale, silty, gray; carbonaceous shale; (approximate base of Lance Formation)--	340	345
Sandstone, fine-grained, gray; carbonaceous shale; coal (approximate top of Fox Hills Formation)-----	345	350
Shale, silty, gray; trace coal-----	350	355
Sandstone, fine-grained, gray; carbonaceous shale; coal-----	355	360
Shale, gray; carbonaceous shale, silty-----	360	365
Sandstone, fine-grained, gray-----	365	370
Do.; coal; shale, gray-----	370	375
Sandstone, fine-grained, gray; carbonaceous shale-----	375	380
Sandstone, medium-grained, gray-----	380	385
Carbonaceous shale; coal; sandstone, medium-grained, gray----	385	390

Drill-hole RS-8-S

Location: SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 34
T. 21 N., R. 101 W.
150 ft FSL 2,100 ft FWL

Total depth: 370 ft
Elevation: 6,940 ft
Point of Rocks quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, medium-grained, brown-----	0	10
Sandstone, medium-grained, white-----	10	20
Sandstone, medium-grained, brown-----	20	25
Carbonaceous shale (with trace gypsum) and carbonaceous mudstone-----	25	30
Sandstone, medium-grained, brown; sandstone, medium-grained, white-----	30	35
Sandstone, medium-grained, tan; coal; carbonaceous shale----	35	40
Sandstone, medium-grained, dark-gray (mixed with coal dust?); trace coal-----	40	45
Sandstone, fine-grained, bluish-gray-----	45	70
Do.; carbonaceous shale-----	70	75
Carbonaceous shale-----	75	80
Do.; trace coal-----	80	85
Coal; trace impure coal; shale, silty, gray-----	85	90
Siltstone, gray; shale, gray-----	90	95
Carbonaceous shale; shale, silty, gray; trace coal-----	95	100
Shale, gray; (water)-----	100	105
Sandstone, coarse-grained, gray-----	105	110
Shale, silty, gray; sandstone, coarse-grained, gray-----	110	115

Drill-hole RS-8-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, coarse-grained, gray; siltstone, gray; trace carbonaceous shale-----	115	120
Carbonaceous shale; shale, silty, gray-----	120	125
Sandstone, fine-grained, gray; carbonaceous shale and shale, gray-----	125	130
Coal-----	130	135
Carbonaceous shale; shale, gray; coal-----	135	140
Sandstone, medium-grained, gray; shale, silty, gray; carbonaceous shale-----	140	145
Siltstone, gray; sandstone, medium- to coarse-grained, gray--	145	150
Sandstone, medium-grained, gray; shale, silty, gray-----	150	155
Shale, silty, gray-----	155	160
Sandstone, fine-grained, gray; shale, silty, gray-----	160	165
Sandstone, fine-grained, gray; coal; carbonaceous shale-----	165	170
Coal; minor carbonaceous shale-----	170	175
Shale, silty, gray; carbonaceous shale-----	175	180
Shale, silty-----	180	185
Sandstone, fine-grained, gray-----	185	190
Sandstone, fine-grained, gray, and coal-----	190	195
Carbonaceous shale; shale, gray-----	195	200
Shale, silty, gray-----	200	205
Shale, gray and siltstone, gray-----	205	210
Siltstone, gray-----	210	215

Drill-hole RS-8-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Carbonaceous shale; siltstone, gray-----	215	220
Shale, silty, gray-----	220	225
Carbonaceous shale; shale, gray; trace sandstone, fine- grained, gray-----	225	230
Shale, silty, gray-----	230	235
Siltstone, gray; shale, silty, gray-----	235	240
Siltstone, gray; shale, gray (approximate base of Almond Formation)-----	240	245
Sandstone, fine-grained, gray (approximate top of Ericson Formation)-----	245	250
Sandstone, medium-grained, gray; sandstone, medium-grained, brown-----	250	255
Sandstone, fine-grained, gray; carbonaceous shale; sandstone, medium-grained, brown-----	255	260
Carbonaceous shale and siltstone, gray-----	260	265
Shale, silty, gray; carbonaceous shale-----	265	275
Shale, silty, gray; sandstone, medium-grained, brown-----	275	280
Sandstone, fine-grained, gray; sandstone, medium-grained, brown-----	280	285
Siltstone, gray-----	285	290
Do.; shale, gray-----	290	295
Siltstone, gray; shale, silty, dark-gray-----	295	300

NOTE: High volume of water is washing up much wall rock.

Sample quality is very poor.

Drill-hole RS-8-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, gray; carbonaceous shale; sandstone, medium-grained, brown-----	300	305
Sandstone, fine-grained, gray; sandstone, medium-grained, brown; trace carbonaceous shale (washed up)-----	305	310
Sandstone, fine-grained, gray; siltstone, dark-gray; trace carbonaceous shale-----	310	330
Sandstone, coarse-grained, gray-----	330	335
Sandstone, medium-grained, gray-----	335	340
Sandstone, fine-grained, gray-----	340	345
Sandstone, medium-grained, gray-----	345	355
Sandstone, coarse-grained, gray-----	355	370

Drill-hole RS-9-S

Location: SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 8
T. 20 N., R. 101 W.
2,300 ft FNL 900 ft FEL

Total depth: 390 ft
Elevation: 6,870 ft
Point of Rocks quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	<u>Depth (ft)</u>	
	<u>From</u>	<u>To</u>
Sandstone, fine- to medium-grained, light-brown; shale, gray-----	0	5
Sandstone, fine-grained, light-brown; mudstone, gray-----	5	10
Sandstone, fine-grained, light-brown; shale, gray-----	10	15
Carbonaceous shale; shale, gray; trace gypsum; trace coal----	15	20
Carbonaceous shale; sandstone, fine- to medium-grained, white; trace coal; trace gypsum-----	20	25
Sandstone, fine-grained, white; sandstone, fine-grained to silty, brown-----	25	30
Shale, silty, gray; traces carbonaceous shale and coal-----	30	35
Sandstone, fine-grained, gray; siltstone, gray-----	35	40
Siltstone, gray; coal; carbonaceous shale-----	40	45
Carbonaceous shale; coal-----	45	50
NOTE: Strong smell of H ₂ S		
Coal; shale, silty, gray-----	50	55
Sandstone, fine- to medium-grained, gray-----	55	60
Carbonaceous shale and impure coal; traces of mudstone, dark-gray and sandstone, fine-grained, gray-----	60	65
Coal; siltstone, brown and sandstone; (water and H ₂ S)-----	65	70
Shale, gray; carbonaceous shale; trace coal-----	70	75

Drill-hole RS-9-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, medium-grained, gray; shale, gray; trace carbonaceous shale-----	75	80
Sandstone, medium-grained, gray; carbonaceous shale; shale, gray-----	80	85
Sandstone, medium- to coarse-grained, gray; trace carbonaceous shale-----	85	90
Sandstone, medium-grained, gray; carbonaceous shale-----	90	95
Shale, silty, gray-----	95	100
Sandstone, coarse-grained, gray-----	100	105
Sandstone, medium-grained, gray-----	105	110
Carbonaceous shale; sandstone, fine-grained, gray; shale, gray-----	110	115
Shale, gray; carbonaceous shale; sandstone, fine-grained, gray-----	115	120
Shale, gray; siltstone, gray-----	120	125
Shale, silty, gray; mudstone, gray-----	125	130
Carbonaceous shale to shale, very carbonaceous, dark-gray---	130	135
Shale, silty, gray; sandstone, fine-grained, gray; carbonaceous shale-----	135	140
Sandstone, fine-grained, gray; shale, silty, gray; carbonaceous shale-----	140	145
Shale, silty, gray; siltstone, gray-----	145	150
Siltstone, gray and shale, silty, gray-----	150	155

Drill-hole RS-9-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Siltstone, gray; sandstone, fine-grained, gray; shale, gray; trace carbonaceous shale-----	155	160
Shale, silty, gray; carbonaceous shale to impure coal-----	160	165
Shale, very silty, gray; carbonaceous shale-----	165	170
Sandstone, fine-grained, gray; trace coal-----	170	185
Shale, silty, gray; siltstone, gray-----	185	190
Siltstone, dark-gray; carbonaceous shale-----	190	195
Sandstone, fine-grained, gray; trace carbonaceous shale-----	195	200
No sample recorded-----	200	205
Shale, gray; trace carbonaceous shale-----	205	210
Shale, gray; carbonaceous shale; siltstone, gray-----	210	215
Siltstone, dark-gray-----	215	230
Sandstone, fine-grained, gray-----	230	235
Sandstone, medium-grained, gray; shale, gray (approximate base of Almond Formation)-----	235	240
Sandstone, fine-grained, gray; trace carbonaceous shale (approximate top of Ericson Formation)-----	240	270
Sandstone, medium-grained, gray; trace coal-----	270	275
Sandstone, fine-grained, gray-----	275	295
Sandstone, medium-grained, gray-----	295	300
Sandstone, coarse-grained, gray-----	300	330
Sandstone, medium-grained; trace mudstone, brown-----	330	335
Sandstone, very coarse grained, gray-----	335	340

Drill-hole RS-9-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, fine- to medium-grained, brown-----	340	345
Sandstone, coarse-grained, gray; siltstone, brown-----	345	390

Drill-hole RS-14-S

Location: NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 14
T. 21 N., R. 101 W.
280 ft FNL 2,560 ft FEL

Total depth: 450 ft
Elevation: 6,985 ft
Superior quadrangle

[All measurements are in feet; to convert to meters, multiply by 0.3048.]

<u>Lithologic description</u>	<u>Depth (ft)</u>	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, white to gray (near base of Fort Union Formation)-----	0	5
Sandstone, fine-grained, tan-----	5	10
Sandstone, fine-grained, white; sandstone, fine-grained, tan-----	10	15
Sandstone, fine-grained, white-----	15	20
Sandstone, fine-grained, light-brown; sandstone, fine-grained, gray-----	20	25
Shale, dark-gray, carbonaceous (near top of Lance Formation)-----	25	30
Mudstone, brown, greenish-brown, dark-gray (carbonaceous); carbonaceous shale-----	30	35
Sandstone, fine-grained, gray-----	35	40
Carbonaceous shale; shale, gray-----	40	45
Mudstone, dark-gray-----	45	50
Shale, silty, gray; sandstone, fine-grained, gray-----	50	55
Sandstone, fine-grained, gray; shale, gray-----	55	60
Shale, gray-----	60	65
Shale, silty, gray to dark-gray-----	65	70
Shale, gray / carbonaceous shale; trace coal-----	70	75
Sandstone, fine-grained, gray-----	75	80

Drill-hole RS-14-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, grayish-blue-----	80	85
Siltstone, gray-----	85	90
Shale, dark-gray-----	90	95
Sandstone, fine-grained, gray to bluish-gray-----	95	100
Sandstone, fine-grained, gray; trace shale, gray-----	100	105
Sandstone, fine-grained, gray; shale, gray-----	105	110
Shale, silty, gray; carbonaceous shale-----	110	115
Siltstone, gray-----	115	120
Do.; shale, silty, gray-----	120	130
Siltstone, gray / carbonaceous shale; trace coal-----	130	135
Siltstone, gray-----	135	140
Sandstone, very fine grained, gray and dark-gray-----	140	145
Sandstone, very fine grained, gray; shale, silty, dark-gray; trace carbonaceous shale-----	145	150
Sandstone, fine-grained, gray-----	150	155
Do.; shale, silty, gray-----	155	160
Coal; sandstone, fine-grained, gray-----	160	165
Siltstone, sandy, gray-----	165	170
Sandstone, very fine grained, gray-----	170	175
Siltstone, gray; shale, gray-----	175	190
Shale, gray-----	190	195
Do.; siltstone, gray-----	195	200
Siltstone, gray-----	200	205

Drill-hole RS-14-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Shale, gray; coal-----	205	210
Coal and carbonaceous shale-----	210	215
Coal and carbonaceous shale / shale, gray-----	215	220
Shale, gray-----	220	225
Shale, silty, gray; sandstone, fine-grained, gray-----	225	230
Carbonaceous shale and shale, gray-----	230	235
Sandstone, fine-grained, gray; shale, gray-----	235	240
Shale, gray-----	240	245
Carbonaceous shale and shale, silty, gray-----	245	250
Siltstone, gray; shale, gray; trace carbonaceous shale-----	250	255
Coal and carbonaceous shale; shale, gray; sandstone, fine-grained, gray-----	255	260
Sandstone, fine-grained, gray; coal and carbonaceous shale---	260	265
Sandstone, medium-grained, gray-----	265	270
Siltstone, gray; shale, gray-----	270	280
Sandstone, fine-grained, gray-----	280	290
Coal-----	290	295
Shale, gray; coal; carbonaceous shale-----	295	300
Shale, gray-----	300	310
Do.; trace siltstone-----	310	315
Shale, gray-----	315	320
Siltstone to fine-grained sandstone, gray; carbonaceous shale; trace coal-----	320	325
Shale, gray; carbonaceous shale-----	325	330

Drill-hole RS-14-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Carbonaceous shale; shale, gray; trace sandstone, fine-grained, gray-----	330	335
Sandstone, fine-grained, gray; carbonaceous shale-----	335	340
Sandstone, medium-grained, gray; shale, gray; carbonaceous shale-----	340	345
Sandstone, medium-grained, gray; siltstone, gray; trace carbonaceous shale-----	345	350
Sandstone, fine-grained, gray; carbonaceous shale; coal-----	350	355
Shale, silty, gray; carbonaceous shale; trace coal-----	355	360
Carbonaceous shale; sandstone, fine-grained, gray-----	360	370
Sandstone, medium-grained, gray-----	370	375
Do.; carbonaceous shale and coal-----	375	380
Shale, silty, gray; sandstone, fine-grained, gray; carbonaceous shale-----	380	385
Sandstone, fine-grained, gray; trace carbonaceous shale-----	385	390
Sandstone, fine-grained, gray-----	390	395
Do.; carbonaceous shale; coal-----	395	400
Sandstone, fine-grained, gray; coal-----	400	405
Coal; carbonaceous shale; sandstone, fine-grained, gray (base of Lance Formation)-----	405	410
Sandstone, fine-grained, gray; traces carbonaceous shale and coal (top of Fox Hills Formation)-----	410	415
Sandstone, fine -grained, gray-----	415	425
Do.; trace coal (washed up)-----	425	430

Drill-hole RS-14-S - continued

<u>Lithologic description</u>	Depth (ft)	
	<u>From</u>	<u>To</u>
Sandstone, fine-grained, gray; traces coal, carbonaceous		
shale, shale, gray (washed up)-----	430	435
Sandstone, fine-grained, gray-----	435	450